



Welcome to the US Army Corps of Engineers  
**Los Angeles District**

**SAN BERNARDINO COUNTY, CALIFORNIA**

# **SEVEN OAKS DAM**

## **INTERIM WATER CONTROL PLAN PRIOR TO AND DURING SECTION 7 CONSULTATION PERIOD**

**January 2000**

**PREPARED BY  
RESERVOIR REGULATION SECTION  
CORPS OF ENGINEERS**

CESPD-ET-EW (CESPL-ED-HR/ 16 Nov 99) (1110-2-240b) 1st End Bigornia/977-8102  
SUBJECT: Seven Oaks Dam Interim Water Control Plan

DA, South Pacific Division, Corps of Engineers, 333 Market Street, Room 923, San Francisco,  
California 94105-2195

**11 JAN 2000**

FOR Commander, Los Angeles District, ATTN: CESPL-ED-HR

1. The Seven Oaks Dam Interim Water Control Plan Prior to and During Section 7 Consultation Period, November 1999 has adequately addressed comments of 4 May 1999 and is thus herein approved.
2. The final water control plan shall be based on the results of the ongoing Section 7 Consultation process. Request that monthly updates on the status of the consultation be provided to CESPD-ET-EW.

FOR THE COMMANDER:



JACK E. FARLESS  
Chief, Engineering Division

Encl  
wd encl



**DEPARTMENT OF THE ARMY**

LOS ANGELES DISTRICT, CORPS OF ENGINEERS  
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CESPL-ED-HR (1110-2-240b)

16 November 1999

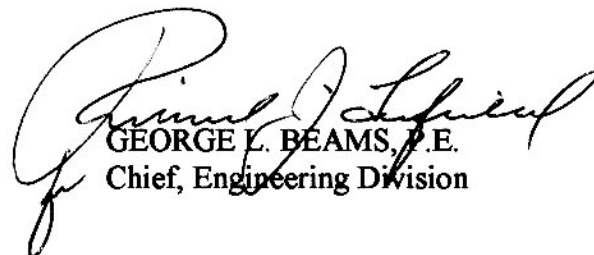
MEMORANDUM FOR Commander, South Pacific Division, ATTN: CESPD-ET-EW

SUBJECT: Seven Oaks Dam Interim Water Control Plan

1. Enclosed are four copies of the draft Seven Oaks Dam Interim Water Control Plan prepared in accordance with EM 1110-2-3600 "Management of Water Control Systems" for your review and approval. The draft manual contains the water control plan that was designed for implementation beginning this flood season and is to remain in force until the Los Angeles District completes the consultation process, as required by Section 7 of the Endangered Species Act.

2. Since we are fast approaching the flood season, we request your prompt action to this matter. If you have any questions, please call Melvin Meneses of our Reservoir Regulation Section at (213) 452-3530.

Encl

  
GEORGE L. BEAMS, P.E.  
Chief, Engineering Division

**Interim Water Control Plan  
Prior to and During Section 7 Consultation Period**

**Seven Oaks Dam  
Santa Ana River Basin, San Bernardino County, California**

**January 2000**

Prepared By:  
U.S. Army Corps of Engineers  
Los Angeles District  
Reservoir Regulation Section



**SEVEN OAKS DAM, SAN BERNARDINO COUNTY, CALIFORNIA**  
**INTERIM WATER CONTROL PLAN PRIOR TO AND DURING SECTION 7 CONSULTATION PERIOD**

**Interim Water Control Plan**  
**Prior to and During Section 7 Consultation Period**  
**Seven Oaks Dam**  
**Santa Ana River Basin, San Bernardino County, California**

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## I. INTRODUCTION

**1-1. Background.** The construction of Seven Oaks Dam is scheduled for completion in the Fall of 1999. However, the inclusion of a new species on the endangered species list, the San Bernardino Kangaroo Rat (see Photo 1), which exists in the Santa Ana River downstream of the dam, requires the Corps of Engineers to enter into Section 7 consultation with the U.S. Fish and Wildlife Service before the final water control plan can be implemented. In fact, the final water control plan may differ from the original plan contained in the project's design documents depending upon the results of the Section 7 consultation. This document (entitled "Seven Oaks Dam Interim Water Control Plan Prior to and During Section 7 Consultation Period") was prepared in order to present the project's operation plan (called "Interim Plan" in this document) prior to and during the consultation period. The Interim Plan takes effect beginning with the year 2000 flood season and is to remain in force until the consultation process is complete and a water control plan for normal flood control operation is approved. Other water control documents to be prepared subsequent to this document are: 1) a Preliminary Water Control Plan document which will take effect for one year to allow time for the preparation and approval of the Water Control Manual, and 2) the Water Control Manual. Both of these documents will contain the flood control operation plan of the project.

**1-2. Purpose.** The purpose of this document is to provide a detailed plan for the safe and effective operation of Seven Oaks Dam prior to and during the Section 7 consultation period. It describes the overall interim water control plan including operational procedures during normal conditions and during high inflow periods. Other topics contained in the document include watershed characteristics, project components, the hydrometeorological instrumentation that is essential to the implementation of the interim plan, and other related information. Should a situation arise where modification to this document including the plan contained in it is necessary, the document may be modified, as required to ensure the safest and most

effective operation of the dam during the period that this water control document is in force.

**1-3. Endangered Species Act (ESA).** The Endangered Species Act of 1973 requires all Federal Agencies to utilize their authorities to carry out programs for the conservation of endangered and threatened species. Section 7 Paragraphs (2) and (3) of the ESA states:

*“Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.”*

*“Subject to such guidelines as the Secretary may establish, a Federal agency shall consult with the Secretary on any prospective agency action at the request of, and in cooperation with, the prospective permit or license applicant if the applicant has reason to believe that an endangered species or a threatened species may be present in the area affected by his project and that implementation of such action will likely affect such species”.*

Three federally listed endangered species, the San Bernardino Kangaroo Rat, the Santa Ana Woolly Star, and the Slender-horned Spineflower, co-exist on the floodplains of the Santa Ana River downstream of Seven Oaks Dam. These species depend upon periodic flooding for habitat rejuvenation, and ultimately, for their survival. Since their habitats are located in areas potentially affected by the operation

of Seven Oaks Dam, formal consultation with the USFWS is required by Section 7 of the Endangered Species Act. The Section 7 consultation will evaluate the effects attributed to the incremental change between the “existing (January 1998)” condition and the future with-project condition of the flood control operation. Based on the findings of this evaluation, modifications to the water control plan, as described in the original design documents, may result in order to avoid, or minimize the impacts to the subject species. The formal consultation period will start upon the Corps’ completion and submission of a Biological Assessment to the USFWS.

**1-4. Previous Environmental Documentation.** While this interim plan is different from the original water control plan contained in the project’s design documents in terms of flood control objectives, the two plans are similar in nature since their operation schedules result in the same release magnitudes in every pool elevation range. Therefore, the original water control plan’s NEPA documentation is applicable to this interim plan prior to and during the Section 7 consultation period.



**Photo 1. The San Bernardino Kangaroo Rat**

## **II - SEVEN OAKS DAM DRAINAGE AREA**

**2-1. Topography.** Seven Oaks Dam controls the upper Santa Ana River basin, which is a subarea of the 2,255 square mile drainage area above Prado Dam (see Plate 1). Plate 2 shows the Seven Oaks Dam watershed which has an area of approximately 177 square miles, excluding the closed area of 32 square miles tributary to Baldwin Lake. The headwaters lie within the rugged San Bernardino Mountains. Elevations vary from 10,664 feet, NGVD at Anderson Peak and 11,502 feet, NGVD at San Gorgino Peak to 2,060 feet, NGVD at the dam site, which is approximately 1 mile upstream from the mouth of the upper Santa Ana canyon. Generally trending southwesterly, the 27 miles of the Santa Ana River upstream of the dam site have an average gradient of 300 feet per mile. Bear Creek, the principal tributary within the Seven Oaks canyon area, drains 55 square miles and possesses an average gradient of approximately 460 feet per mile. Well-developed growths of fir and pine occur above elevation 5,000 feet, NGVD. Many steep slopes within the watershed are covered with a moderate to dense growth of chaparral and sage scrub. Lower slopes carry a heavy cover of grasses and forbs. The drainage area above the dam is expected to remain largely undeveloped during the entire life of the project.

**2-2. Structures Affecting Runoff.** Big Bear Dam is the only existing structure which affects flood flows into Seven Oaks reservoir. Big Bear Lake is a water conservation reservoir, owned by the Big Bear Municipal Water District. It has a drainage area of about 38 square miles and has a surcharge storage of about 8,600 acre-feet between the top of the conservation pool and the top of dam.

**2-3. Related Control Facilities.** There are four other flood control projects located within the Santa Ana River watershed. Prado Dam, San Antonio Dam, and Carbon Canyon Dam are owned and operated by the Corps of Engineers. Villa Park Dam is owned and operated by the Orange County Public Facilities and Resources Department. These projects including Seven Oaks Dam are shown on Plate 1.

## **2-4. Hydrometeorological Stations.**

a. **Los Angeles Telemetry System (LATS).** Hydrometeorological gaging stations located in the Seven Oaks Dam basin are part of the Los Angeles Telemetry System (LATS). The District administers this network of real-time hydrometeorological gaging stations which provides reservoir regulation personnel with immediate notification of precipitation, streamflow, temperature and reservoir water surface elevation data for the Los Angeles County Drainage Area and the Santa Ana River drainage. The gages collect and store raw data using on-site remote terminal units (RTU). The information is then transmitted by a line-of-sight FM radio contained in the RTU to a repeating station. (The Keller Peak repeating station is used for the Seven Oaks basin gages except for the Converse and Santa Ana River at Mentone stations which use the Pleasants Peak repeater.) The repeater relays the data to the District's Water Control Data System (WCDS) by microwave link. Data received at the District office is processed and entered into the WCDS database (HECDSS). The data is also sent on to the LATS Central Computer located at the Baseyard in El Monte, California. Plate 1 shows the gaging stations located in the entire Santa Ana River Watershed including the Seven Oaks Dam watershed.

LATS supports three types of data reporting: (1) event reporting; (2) poll reporting; and (3) timed reporting. Event reporting is when stations automatically report when a threshold is reached. The current criteria for reporting is every 0.04" of rain for rain gages and  $\pm 0.25'$  for reservoir and stream level gages. As the criteria is met, the station transmits the report through the system to the District office computers. Any LATS gage can also be polled (interrogated) for data at any time via the LATS Central Computer located at the Baseyard. This task can be accomplished from any X-Windows supporting computer directly connected to the District network. Finally, each station can be programmed to report at some predetermined time each day.

1. **At Seven Oaks Dam.** Hydrologic facilities at and in the vicinity of the dam consist of a rain gage, reservoir water level recording equipment, an RTU, and a series of reservoir staff gages located on the upstream embankment near the left abutment (see Table 2-1). Facilities about a mile downstream of the dam, near

Mentone consist of a combined stream and rain gaging station with an RTU (see Table 2-2).

**Table 2-1  
Hydrologic Instrumentation  
Seven Oaks Dam**

Parameter	Gage Type	Report Mode	Stored Record	Comments
Water Surface Elevation	Staff Boards	Visual Inspection	Flood Control Basin Operation Report SPL 19	
	Design Analysis H-350 Combination Pressure Transducer/Data Logger, RTU*	Telemetry Visual Inspection	Data Logger Output File HECDSS Database File	Orifice Line
Downstream Gage Height (also shown on Table 2-2 below)	RTU, A35 Stevens Recorder	Telemetry Visual Inspection	HECDSS Database File	Float Well USGS Gage 11051500
Precipitation	Novalynx Tipping Bucket	Telemetry	HECDSS Database File	
	Glass Rain Tube	Visual Inspection	Rainfall Record SPL 31	

\*RTU- REMOTE TERMINAL UNIT

**Table 2-2  
LATS Stream Gages Pertinent to  
Seven Oaks Dam**

Location	Drainage Area (sq. mi)	Latitude	Longitude	Elev. (feet, NGVD)	Period of Record
<b>SAR Near Mentone, CA #11051500</b> <b>USGS (SARM) RTU 57</b> (also shown on Table 2-1 above)	<b>210</b>	<b>34-06-30</b>	<b>117-05-59</b>	<b>1,950</b>	<b>01/1896 – Present</b>
<b>SAR above Seven Oaks Dam COE (SARO) RTU 85</b>	<b>161</b>	<b>34-08-33</b>	<b>117-04-08</b>	<b>2,550</b>	<b>10/1997 – Present</b>

NOTES:

1. See Plate 1 for Locations
2. Drainage Area excludes 38-sq. mi. non-contributing area from Baldwin Lake.

**2. Within Seven Oaks Drainage Basin.** Hydrometeorological data covering the Seven Oaks Dam drainage area are provided by the rain gages shown on Table 2-3 and one streamgage shown on Table 2-2. Rain gages include locations at Heart Bar, Converse Fire Station, Big Bear Ranger Station and Manzanita Flats. All gaging stations include an electrically heated tipping bucket rain gage, RTU and digital recorder. One streamgage can be found upstream of the dam at the Southern California Edison bridge crossing (Table 2-2). This gage operates utilizing a pressure transducer, recording equipment and a RTU (Note: This gage was installed for construction purposes only and maybe discontinued later on).

**b. Stations Maintained by Others.** San Bernardino County Flood Control District (SBCFCD) maintains a network of precipitation gages throughout the county. Precipitation data is collected from seven stations within the Seven Oaks Dam drainage area (Table 2-4). These stations are: (1) Big Bear Community Services District; (2) Big Bear Hospital; (3) Big Bear Dam; (4) Camp Angelus; (5) Santa Ana Powerhouse #3; (6) Manzanita Flats; and (7) Heart Bar. The Manzanita Flats and Heart Bar stations are co-located with the Corps' LATS System stations. The Big Bear Dam and Camp Angelus stations are operated in conjunction with the NWS. Except for the Manzanita Flats and Heart Bar stations, the data provided by these gages is not available to the ROC in during real-time operations.

**Table 2-3**  
**LATS Rain Gages Pertinent to Seven Oaks Dam**

Location	Corps ID	Latitude	Longitude	Elev	Period of Record	RTU ID
Big Bear Lake Ranger Station	BBRS	34-16-58	116-54-07	6,940	11/95-pr	84
Manzanita Flats	MANZ	34-09-36	117-02-47	3,920	11/95-pr	82
Heart Bar	HBAR	34-09-31	116-46-56	6,690	11/95-pr	83
Converse Fire Station	CONV	34-11-38	116-54-49	5,600	1/92-pr	25
Seven Oaks Dam	SOAK	34-06-50	117-05-50	2,600±	1999-pr	68
Santa Ana R. nr Mentone	SARM	34-06-30	117-05-59	1,950	07/1896-pr	57

**Table 2-4**  
**Other Rain Gages Pertinent to Seven Oaks Dam**

Location	User	Latitude	Longitude	Elev (feet,NGVD)	Period of Record	Sta ID
Big Bear Community Svcs. Dist.	SBCFCD	34-15-40	116-50-34	6,940	1950-pr	6091A
Big Bear Hospital	SBCFCD	34-14-46	116-53-06	6,800	1981-pr	6363
Big Bear Dam	SBCFCD/NWS	34-14-31	116-58-33	6,815	1884-pr	6032/0742
Camp Angelus	SBCFCD/NWS	34-09-00	116-59-02	5,780	1967-pr	3260/1369
Santa Ana Powerhouse #3	SBCFCD	34-06-39	117-05-56	1,980	1984-pr	3162
Manzanita Flats	COE/SBCFCD	34-09-36	117-02-47	3,920	11/95-pr	82/3002

SBCFCD - San Bernardino County Flood Control  
COE - Corps of Engineers  
NWS - National Weather Service

### III - SEVEN OAKS DAM OUTLET WORKS COMPONENTS

**3-1. General.** Plates 3 and 4 show the site plan, and the general plan and profile of the outlet works. In order to implement the water control plan, Seven Oaks Dam was designed with outlet works consisting of two intake systems and three separate control systems. The two intake systems, shown in detail on Plates 5 and 6 are: 1) the main intake system with a 36-foot-diameter wet-well designed to pass flows at high reservoir pool elevations, and 2) the low pool multilevel withdrawal intake with an 8-foot x 8.5-foot wet well designed for passing flows at low elevations. The three control systems, namely 1) the Regulating Outlet (RO), 2) Low Flow (LF) Outlet, and 3) the Minimum Discharge Line (MDL) are designed to regulate outflow over a wide range of reservoir pool elevations (El. 2100 feet, NGVD to El. 2580 feet, NGVD) and design discharges (10 cfs to 8,000 cfs). The following describes the above mentioned components and other related features of the outlet works:

**a. Main Level Intake Structure (MLS).** Also known as the high level intake structure, the MLS is a tower with a 36-foot inside diameter wet well and is designed for passing flows at high reservoir pool elevations during the initial life of the project. Flows enter the wet well through a trash structure at the top of the tower. As the expected sediment deposition in the forebay rises to elevation 2265 feet, NGVD, the multilevel withdrawal intake (see Section 3-1.b below) will no longer be functional and the MLS will be used for all discharges.

**b. Multilevel Withdrawal Structure (MWS).** The MWS consists of a tower with multiple levels of ports to pass flows at low elevations and avoid dead storage prior to the expected sediment desposition reaching elevation 2265 feet, NGVD. There are 18 pairs of MWS ports and each port measures 27 inches in diameter. The ports are spaced at 10-foot intervals starting at centerline El. 2104.24 feet, NGVD. Over the life of the project, the ports will be blocked as the sediment deposition level rises in order to minimize the sediment entering the outlet works. The design documents recommend blocking the ports with stoplogs between 20 feet to 30 feet above the current sedimentation level. The stoplogs are designed to be removable,

thus providing the capability of dewatering the debris pool after each flood season. During Water Year 2000, the first two rows of ports will be stoplogged. The invert of the next row of ports is at elevation 2120.24 feet, NGVD so the initial sediment pool is about 24 feet deep. A 6-foot x 6-foot conduit equipped with a sluice gate connects the MLS wet well and the MWS wet well. The sluice gate located in the MWS wet well at the entrance to the conduit is to remain closed whenever the LO and RO gates are not in use. The sluice gate is to be open when the pool is below the high level intake (El 2265 feet, NGVD) and the required discharges are greater than 90 cfs. The sluice gate is not intended for throttling and is operated either in open or closed positions only. Section 4-2.a outlines the procedures in opening the sluice gate prior to using the tunnel for releases .

**c. Regulation Outlet Gates (RO Gates).** Flows from the main pressure conduit are regulated by either the RO gates and/or the low flow gate. The two hydraulically operated RO slide gates measure 5-foot wide by 8.5-foot high each. Upstream of each RO gate is an emergency gate with the same dimensions. The minimum gate opening for the RO gates is 9 inches in order to eliminate the possibility of vibration damage due to shifting control at the gate lip caused by high velocities at low openings. Conversely, a maximum gate opening of 7.0 feet (roughly 80 percent opening) is required in order to minimize the possibility of cavitation to the concrete. A single RO gate can pass approximately 58 percent of the 8,000 cfs design discharge at elevation 2580 feet, NGVD at the maximum gate opening of 80 percent. The RO gates are used for discharges ranging between 500 cfs to 8,000 cfs. See Plates 7, 8 and 9 for details of the gate chamber area.

**d. Low Flow Gate.** The low flow gate is a hydraulically operated slide gate measuring 2-foot wide by 3.5-foot high designed to eliminate the need to operate the RO gates at less than their required minimum openings of 9 inches. In addition, the low flow gate provides flexibility in gate operation since it can also be used with the MWS intake during low flows. An emergency gate with the same dimensions is located upstream of the low flow gate. The minimum gate opening for the low flow gate is 6 inches, and its maximum opening is limited to 3.0 feet. The low flow gate is

designed to discharge flows ranging from 90 cfs to 500 cfs. See Plates 7, 8 and 9 for details of the gate chamber area.

**e. Pressure Conduit, Mid-Tunnel Gate Passages, and the Downstream**

**Conduit.** The conduit upstream of the RO gates is designed for pressures up to 504 feet of head under static conditions. The conduit transitions from a 7-foot-wide by 13.5-foot-high section at the intake tower to an 18-foot-diameter section over a length of 60 feet. The 18-foot-diameter circular portion has a total length of 875 feet. The conduit then transitions to an 18-foot-high by 23-foot-wide modified horseshoe section over 45 feet to the upstream ends of the splitter piers which separate the RO and low flow gate passages. At the design discharge of 8,000 cfs, the average velocity in the 18-foot-diameter conduit is 31.4 feet per second. The absolute roughness value used for the design was 0.0005 feet. The two 5.5-foot-wide splitter piers divide the flow symmetrically into two 5-foot-wide by 8.5-foot-high RO conduits and a 2-foot-wide by 3.5-foot-high low flow conduit located between the RO conduits over a length of 38.5 feet. Conventional one on three elliptical curves were used for the roof and inner side curves on the entrance to the gate passages. These curves form the pier end curves. The RO gates are 34.5 feet downstream of the upstream end of the piers. Downstream of the RO gates, the conduit transitions from a 24-foot-wide by 10-foot-high channel to an 18-foot-wide by 9-foot-high channel over a length of 120 feet. From this point the 28-foot-wide x 9-foot-high downstream conduit extends 540 feet. At station 28+60 the roof of the downstream conduit ends and the exit channel continues to station 30+80 where it terminates and the flow plunges into the energy dissipator. See Plates 7, 8 and 9 for details of the gate chamber area.

**f. Minimum Discharge Line (MDL).** The pipe component of the minimum discharge line is a 3-foot-diameter steel pressure pipe originating at the invert of the MWS wet well. The MDL is regulated by two fixed cone valves, an 8-inch and a 14-inch, housed in the Valve Structure located at the downstream end and on the left side of the exit chute. The MDL passes a discharge ranging from 10 cfs to 90 cfs. A 24-inch-diameter ball valve is provided in the mid-tunnel gate chamber to provide

emergency closure and to dewater the downstream portion of the conduit prior to inspection and/or maintenance of the MDL. Section 4-2.d outlines the procedures for dewatering the MDL conduit downstream of the ball valve.

**g. Wet Well Sluice Gate.** The wet well sluice gate is located in the multi-level withdrawal system wet well at the entrance to a 6' x 6' conduit that leads to the main wet well. When closed, the sluice gate prevents the flow from entering into the main wet-well and the main tunnel. In order to open the sluice gate, no more than 2.5 feet of head differential between the two wet wells can exist. Section 4.2a outlines the procedures for operating the sluice gate prior to and after the use of the main tunnel for releases. Plate 6 shows the location of the sluice gate. (**NOTE:** *Once available, a piezometer reading in each wet well will be used to determine when the required head differential is achieved to operate the sluice gate, as described. However, the digital display used to obtain these readings has not been installed to date. In the meantime, in order to prevent the risk of damaging the sluice gate, it will be opened as soon as ROC determines that a significant amount of inflow is projected. Once the digital read display is installed and calibrated, the operation of the sluice gate will be done based on the required head differential, as described above.*)

**h. Energy Dissipator.** The energy dissipator consists of 1) a plunge pool apron located immediately downstream of the exit channel, and 2) a preformed plunge pool located immediately downstream of the plunge pool apron. The plunge pool apron is 105 feet wide and constructed on 1V on 3H slope along the direction of flow. It is designed to prevent the undercutting of the outlet channel. A vertical wall at the toe of the apron extends from elevation 1,990 feet, NGVD to 1,980 feet, NGVD to prevent the undermining of the apron from return flows. The preformed plunge pool was designed based on a maximum discharge of 8,000 cfs. It is composed of a roughly hemispherical excavation partially lined with 5-foot to 6-foot diameter rock protection that extends about 100-feet wide by 100-feet long with a blanket thickness of 10 to 12 feet from elevations 1986 feet, NGVD to 1974 feet NGVD. Downstream of the rock protection, the preformed plunge pool runs for approximately 250 feet on

a 1V to 10H slope, then daylights with the natural river channel. The left and right banks of the plunge pool between elevation 2000 and 2020 are lined with a 4-foot thick layer of 1-foot to 3-foot diameter riprap stone from the apron to the point of daylight with the natural river.

## IV – INTERIM WATER CONTROL PLAN

**4-1. Overall Interim Water Control Plan.** The overall objective of the Seven Oaks Dam Interim Water Control Plan is to pass as much inflow as physically possible without risking public safety and/or the safety of the dam itself. The dam shall also be operated to meet the downstream water rights release requirements prior to and during the consultation period. At times water will be temporarily stored in order to prevent sediment and/or floating debris from blocking inlets or damaging the outlet works. The plan is illustrated in Plate 10 and described as follows:

**a. Sediment Pool (2100 to 2120 feet, NGVD).** At the beginning of each flood season stop logs will be added as necessary to block the lower inlet ports of the multi-level withdrawal system (MWS) wet well. This wet well leads to the minimum discharge line (MDL). The stop logs will be added as necessary to block the ports to a point about 20 to 30 feet above the current invert. This is to be done to prevent sediment from entering the intake structure and either blocking or damaging the MDL. The stop logs will form a “dead pool” and no operation will be possible, other than with the leakage. Additional stop logs may be installed during the flood season if sediment accumulation is greater than expected. During the year 2000-flood season, the two lowest rows of ports will be blocked. The invert of the next row of ports is at elevation 2120.24 feet , NGVD so the initial sediment pool will be about 20 feet deep.

**b. Debris Pool (2120 to 2200 feet, NGVD).** In the first year of project life, the design documents call for a debris pool up to elevation 2200 feet, NGVD. During normal project operations, this pool will be built using inflows which exceed the downstream water rights requirements and will be held until the end of the flood season, when it will be released at a rate consistent with downstream water rights. Prior to and during the consultation period, however, this pool will only be built on the rising limb of storm events and will be drained as rapidly as possible (down to elevation 2134 feet, NGVD) once the threat of debris plugging the MWS ports has passed. Generally this will occur when the storm inflows have receded to near base

flow. The maximum combined capacities of the MDL and low flow gate will be used, which is between 400 to 500 cfs at this range. Prior to using the low flow gate, however, the wet well sluice gate needs to be opened, see Section 4-2a for details. During falling stages, release the maximum combined capacities of the MDL and the low flow gate until the water surface elevation drops to below 2134 feet, NGVD. Below elevation 2134 feet, NGVD, the sluice gate will be closed and releases shall be made through the MDL only. (Note: The low flow gate will be used in order to drain the main tunnel).

**c. Intermediate Pool Elevations (2200 to 2265 feet, NGVD).** The intermediate pool elevations occur between the top of the debris pool and the sill of the main intake. During water year 2000 this range is between elevations 2200 and 2265 feet, NGVD. Within this range the pool will be evacuated as rapidly as possible. If the storm inflow rate is less than the release capability, the pool will be drawn down to elevation 2200 where it will be held until the storm inflow recedes to a rate near base flow. The combined release capacities of the low flow gate and the MDL in this range is approximately 400 to 500 cfs. If the storm inflow is greater than the release capacity the maximum combined release will be made until elevation 2265 feet, NGVD is reached. Section 4-2b outlines the permissible rates of release change when increasing or decreasing outflow.

**d. Main Trash Rack (2265 to 2299 feet, NGVD).** The trash racks protecting the main intake are located between elevations 2265 and 2292.5 feet, NGVD. During rising stages at Seven Oaks Dam there will be no release of water through the main wet well RO or LF gates when the pool is between elevations 2265 and 2299 feet, NGVD. The reason for this is to avoid drawing floating debris into the trash racks and possibly rendering the main outlets inoperative. During rising stages releases will be made through the MDL in this elevation range at the maximum safe rate. The maximum safe rate will be determined by project experience but is theoretically on the order of 50 cfs. Project experience will also indicate whether the sluice gate needs to be closed while operating in this range. If significant quantities of floating debris are drawn into the racks, with the gate left open, then this plan will need to be

modified to allow the dam tenders time to close the gate before the access deck submerges. During falling stages, releases will be made in accordance with the project design schedule shown on Plate 10. These theoretical maximum safe rates range up to 2000 cfs (see Plate 10). If project experience indicates that floating debris is less of a problem than anticipated the falling pool release rates may be increased. Conversely, if operational experience indicates that floating debris is more of a problem than anticipated then the falling pool rates may be decreased. Section 4-2b outlines the permissible rates of release change when increasing or decreasing outflow.

**e. Main Pool (2299 to 2580 feet, NGVD).** This is the pool between elevation 2299 feet, NGVD and the spillway crest at elevation 2580 feet, NGVD. Between these elevations water will be released at the maximum safe rate. Operational experience will determine this rate, but it is expected to be near the maximum theoretical gate capacity, which is between 6500 and 8000 cfs. Section 4-2b outlines the permissible rates of release change when increasing or decreasing outflow. (NOTE: Project experience will also determine the most appropriate level of submergence of the trash rack before large releases can begin. The bottom elevation of “main pool”, which is currently set at elevation 2299 feet, NGVD, will then be adjusted accordingly.)

**f. Spillway Surge (2580 to 2604 feet, NGVD).** Above elevation 2580 feet, NGVD releases are uncontrolled over the spillway. During rising stages when uncontrolled releases are less than 8000 cfs, releases from the outlet works will be adjusted so that the total project release equals 8,000 cfs. When uncontrolled releases are greater than 8000 cfs (above elevation 2585 feet, NGVD), no controlled releases will be made. During falling stages, the outlet works gates can be adjusted to maintain the resulting maximum spillway release rate to assure the quick evacuation of the remaining surcharge volume in anticipation of another major storm.

**g. "Initial Filling" Plan.** Although there will be no scheduled or controlled "initial filling" for Seven Oaks Dam during the Section 7 consultation period, there

are certain elevation-based events that will initiate a Geotechnical Branch response. The purpose of the elevation-based Geotechnical response will be to confirm the integrity of the embankment, and the function of the system of seepage monitors and controls.

**1) Elevation 2300 feet, NGVD.** The stability of the slopes below the Intake Access Road will be assessed by personnel from the Geotechnical Branch.

**2) Elevation 2375 feet, NGVD.** The downstream toe of the embankment, adjacent to the right abutment, will be assessed by personnel from the Geotechnical Branch for any local seepage effects related to the grouting of the exposed rock nose at the right abutment.

**3) Elevation 2418 feet, NGVD.** The downstream instrumentation will be monitored by personnel from the Geotechnical Branch, as water is impounded above the abutment drain material.

**4) Elevation 2580 feet, NGVD.** The spillway condition will be assessed by personnel from the Geotechnical Branch.

*(Note: The ROC informs personnel from the Geotechnical Branch when the reservoir pool is projected to reach these elevations.)*

**4-2. Other Operational Requirements.** Although the primary purpose of the operation of Seven Oaks Dam prior to and during the Section 7 consultation period is to pass flow as quickly as possible, the project's operational design criteria needs to be followed in order to assure that the dam's safety is not jeopardized. Plates 11 through 17 were taken from the original design documents and are provided for use in the operation of the dam during the consultation period. The following are requirements that are necessary in the implementation of the interim water control plan contained in this document:

**a. Head Differential Prior to Opening of the Wet Well Sluice Gate.** During periods of low flows, the MDL is used to pass flows and the wet well sluice gate is normally closed. As inflow and water surface elevation rise, the RO and LF (see Sections 3.1c and 3.1d) gates in the main tunnel are needed to discharge at rates higher than the MDL alone can pass. In order to use the main tunnel when the water surface elevation is lower than 2265 feet, NGVD, the sluice gate needs to be opened. Prior to the opening of the sluice gate, however, a head differential of no more than 2.5 feet between the MWS wet well and MLS wet well should exist<sup>1</sup>. The following provides guidance in achieving the required head differential prior to the opening of the sluice gate (as project experience is gained, this procedure shall be modified):

1. Cut off MDL release using either the two cone valves located in the valve structure, or the MDL ball valve located in the gate chamber.
2. Open the 9-inch-diameter filling valve to water up the upstream portion of the tunnel. The time required for filling the tunnel ranges from 4 to 8 hours.
3. Once a head differential of 2.5 feet is achieved, open the sluice gate.
4. The LF and/or the RO gates can now be used for discharging higher flows. However, the rate of release change restrictions (Section 4-2.b) and the maximum allowable gate opening (Section 4.2c) should be followed.

Note: When closing the sluice gate, the RO and LF gates need to be closed first prior to setting the sluice gate to closed position.

**b. Rate of Release Change Restrictions.** The maximum permissible rate of change in releases is dependent upon the magnitude of the current release. When increasing or decreasing the release rate, the water control manager at the Reservoir

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<sup>1</sup> *Once available, a piezometer reading in each wet well will be used to determine when the required head differential is achieved to operate the sluice gate, as described. However, the digital read display used to obtain these readings has not been installed to date. In the meantime, in order to prevent the risk of damaging the sluice gate, it will be opened as soon as ROC determines that a significant amount of inflow is projected. Once the digital read display is installed and calibrated, the operation of the sluice gate will be done based on the required head differential.*

Operation Center (ROC) should consider the possibility of structural damage to downstream improvements, levee bank sloughing due to rapid bank de-watering and public safety among other things. Furthermore, other government agencies and affected parties are notified by the ROC prior to any significant change in releases. These notifications are documented in the “Instructions for Reservoir Operations Center Personnel” (the AOrange Book) published by the Los Angeles District. Table 5 outlines the recommended maximum permissible rates of release changes under normal operating conditions. These rates are based on LAD experience with similar projects having unimproved downstream channels. Note that conditions in the downstream channel (erosion, overbank flow, etc.) may result in a slower rate of change of release. The dam tenders, or channel observation teams may be directed by the ROC to observe the effects of increased flows upon downstream channel conditions.

**Table 3-1  
Recommended Maximum Rate of Release Change  
Seven Oaks Dam**

Current Rate of Release (cfs)	Maximum Rate of Change per Hour (cfs)	
	To Increase Flow	To Decrease Flow
0 – 200	No restriction	No restriction
Up to 500	250	250
500-4000	500	500
4000- 8000	1000	1000

c. **Minimum and Maximum Gate Openings.** The minimum and maximum gate openings for both the RO and LF gates are shown on Table 3-2 below. A minimum

gate opening is required to eliminate the possibility of vibration due to shifting control at the gate lip caused by high velocities at low openings, while a maximum gate opening is required in order to minimize the possibility of cavitation.

**Table 3-2**  
**Minimum and Maximum gate Openings**  
**Seven Oaks Dam**

GATE TYPE	MINIMUM GATE OPENING (feet)	MAXIMUM GATE OPENING (feet)
Main Regulation Outlet (R.O.)	0.75	6.8
Low Flow (LF)	0.5	2.8

**d. Dewatering the Downstream MDL Conduit.** For maintenance, inspection and emergency purposes, dewatering of the MDL conduit downstream of the ball valve is accomplished by the following:

1. Shut off flow in the MDL using the two cone valves located in the valve structure.
2. Close the ball valve located in the gate chamber.
3. Open the two cone valves in the valve structure to dewater the downstream end of the MDL.

**f. Prototype Testing Program.** The Seven Oaks Dam project includes hydraulic instrumentation features which collect data to 1) evaluate the hydraulic performance of the project, b) analyze potential operation problems, and c) design repairs and/or project modifications to solve potential problems. The instrumentation is intended to measure piezometric head, pressure fluctuations, air demand, and gate vibration. Once the dam is approved for flood control operation, its operation plan will allow procedures to facilitate the collection of data for the testing program. Under this Interim Plan prior to and during Section 7 Consultation, such data collection will be

done if the opportunity exists. The dam, however, will not be operated in order to create such opportunity during the effective period of the Interim Plan.

**g. Procedures for Installing and Removing the Bulkhead Gate for the Upstream Main Conduit.** An outlet bulkhead is located at the entrance to the main conduit. When not in use, the bulkhead gate is stored on the deck of the MLS intake structure. The bulkhead provides the capability to seal and drain the main tunnel to allow inspection or maintenance activities in the portion of the main tunnel upstream of the RO gates (also called the pressure tunnel). The bulkhead is lowered into or raised from the wet well using a truck mounted mobile crane positioned on the deck of the intake structure. A balanced head condition must exist when installing or removing the bulkhead gate. The 9-inch-diameter filling valve can be used to water up the tunnel to achieve balanced head condition. A 12-inch-diameter air vent located downstream of the bulkhead allows air to enter and escape during emptying or filling of the pressure tunnel. The project's O and M manual, once completed, will contain procedures for the installation of the bulkhead gate in the main tunnel. In the meantime, the following steps are provided:

1. Close LF and RO gates.
2. Cut MDL release using the cone valve located in the valve structure.
3. Fill the upstream tunnel. Use the 9-inch-diameter filling valve located in the gate chamber. (Note: If sluice gate is open, and/or water surface elevation is greater than 2265 feet, NGVD, this would not be necessary.)
4. Once a balanced head condition is achieved, close the filling valve and lower the bulkhead gate into the wet well using a truck mounted mobile crane positioned on the deck of the MLS.
5. Drain the upstream portion of the tunnel by gradually opening the RO and LF gates.
6. Open MDL using the cone valve in the valve structure to continue minimum required release.

Once inspection or maintenance is completed and the bulkhead gate needs to be removed, the following procedures are provided:

1. Close RO and LF gates.
2. Cut MDL release using the cone valve in the valve structure.
3. Fill the upstream tunnel using the 9-inch-diameter filling valve located in the gate chamber. Close the filling valve as soon as the tunnel is filled.
4. Remove the bulkhead gate using a truck mounted mobile crane on the deck of the MLS.
5. Continue release as per the water control plan.

Installation of the bulkhead gate will only be performed when the likelihood of the reservoir pool reaching or exceeding elevation 2293 feet, NGVD is remote.

**h. Procedures for Installing and Removing the Bulkhead Gate for the Upstream Conduit of the MDL.** A bulkhead located at the entrance to MDL conduit is provided in order to allow inspection and maintenance of the upstream portion of the MDL conduit. The bulkhead gate is installed in its guides just above the intake and can be raised or lowered by a truck mounted crane located on the MWS intake structure deck. When installing or removing the bulkhead gate, a balanced head condition must exist. A 3-inch-diameter vent is located just downstream of the bulkhead for air to enter when emptying or escape when filling the conduit. The valve can be filled by reversing the flow into the MDL with the 9-inch-diameter filling valve in the gate chamber (if the main tunnel is filled) or pumping water in from the air vent. Actual procedures will be contained in the O and M manual. Note that prior to using the filling valve, the RO and LF gates must be closed. In addition to the bulkhead, several other options exist in allowing access to the upstream MDL conduit, depending on the concurrent reservoir conditions. During periods of low flows, additional stop logs may be installed to stop the flow and allow the wet well to drain prior to inspection or maintenance of the upstream MDL conduit. During periods of high flows, installation of the stop logs and, if

necessary, closure of the sluice gate may be used to totally shut the flow from the MWS intake structure.

**i. Downstream Water Rights.** In addition to flood control, the overall water control plan of Seven Oaks Dam, as described in the original project documents, includes meeting the existing downstream water rights. In general, the dam is to be operated so that during non-flood conditions releases match inflows as closely as possible except when the debris pool is being built. While the debris pool is being built, no release should be made until the inflow recedes back to baseflow. At the end of the flood season, the debris pool will be drained at a maximum rate equal to inflow plus an additional 20 cfs. Project experience will dictate how the dam can be operated effectively to best meet the downstream water rights. During the Section 7 consultation period however, a debris pool will only be built on the rising limb of flood events. Outside of flood events, releases will match inflows as closely as possible, which will meet the downstream water rights. A flood event is defined as inflows which exceed the current baseflow. It is important to note, however, that once the stop logs are in place, the release rates will be limited to leakage when the water surface elevation is within the “Sediment Pool” (see Section 4-1.a).

**4-3. Operational Responsibilities.** The Corps of Engineers through the Reservoir Operation Center (ROC) is charged with the responsibility of regulating Seven Oaks Dam. As part of this responsibility, the ROC staff makes operational decisions, coordinates with and notifies other Corps entities and local agencies, and gives instructions to the dam tenders. The dam tenders perform the physical operation of the gates and the collection of hydrologic data and reservoir status information. This function will be performed by the local sponsors, namely, 1) the San Bernardino Flood Control District, and 2) the Orange County Public Facilities and Resources Department. Communication between the ROC and the dam tenders is accomplished via radio and/or telephone communication systems, as explained in the next Section.

**4-4. Communication Network.** The following section describes the communication facilities at Seven Oaks Dam:

**a. FM Radio Transceiver** - is installed in the downstream access structure to communicate with the Los Angeles District Office and the Corps of Engineers Baseyard in El Monte, California.

**b. Commercial Telephones** - are installed in the instrument house, valve structure, downstream access structure and the gate chamber.

**4-5. Communication with the Project.**

**a. Normal Communication.** During the flood season, a routine report is made at least once each weekday from Seven Oaks Dam to the ROC. This reservoir operation report is usually made prior to 0900 hours PST. During flood events, the reporting interval is more frequent as determined by the ROC. Reporting of reservoir data is initiated by either the ROC or the dam operator depending on the mode selected by the ROC. Other routine or non-routine radio or telephone calls are made as necessary.

During the non-flood season, reports are given once a week from the dam to the ROC on a predetermined schedule.

**b. Loss of Communication.** In the event that all communication with the District, including the ROC and the LAD's Baseyard is interrupted, the dam tender should operate the dam in accordance with the water control diagram as shown on Plate 10. In addition, the dam tender should, if possible, make all necessary notifications, as outlined in the "Orange Book". Every effort to re-establish communication with the District shall, however, be made. Once communication is re-established, the dam tender shall report all gate changes and notifications made to the ROC.

**4-6. Communication Between ROC and Others.** Telephone notifications are given to various in-house sections, county agencies, water districts, and city authorities when flood operations at the dam may cause an impact to property or populations within their jurisdiction. Flood conditions which trigger notifications are found in the Instructions for Reservoir Operations Center Personnel (the "Orange Book") along with associated contacts and telephone numbers.

**4-7. Communication Between Seven Oaks Dam and Others.** No routine communication between staff at Seven Oaks Dam and other agencies is required. In the event of a loss of communication between the ROC and the staff at Seven Oaks Dam, the procedures in Section 4-5b shall be followed.

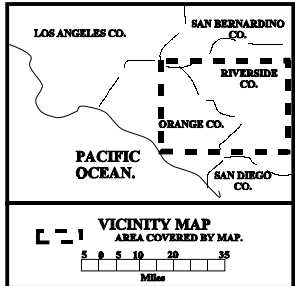
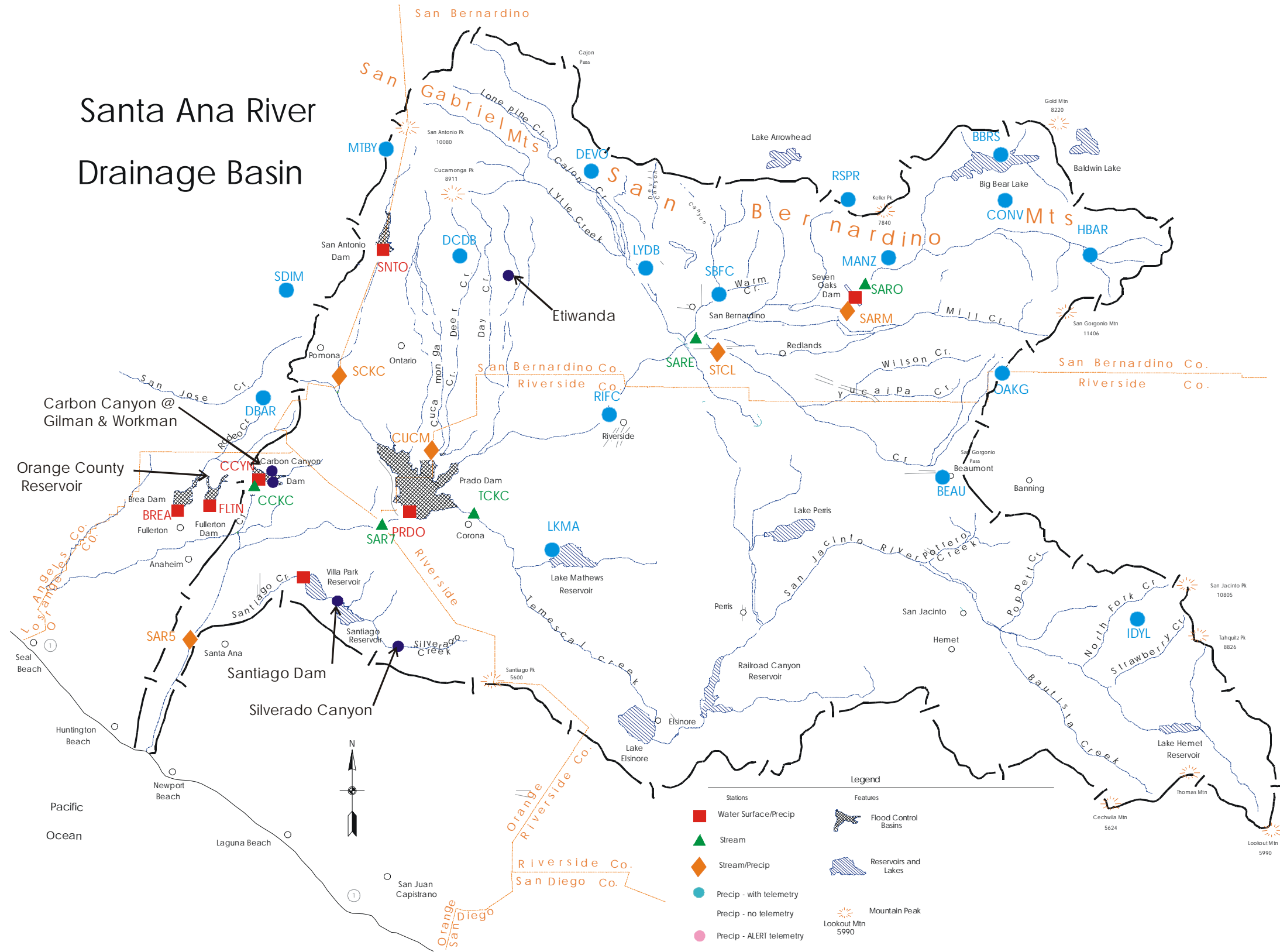
**4-8. Project Reporting Instructions to Dam Tenders.** The dam tender at Seven Oaks Reservoir is required to perform the following:

- a. Be present at the dam when requested by the Corps' dam tender foreman or the ROC. Be present at the dam in accordance with the routine schedule (see Section 4-5.a) unless other arrangements are mutually agreed upon between the dam tender, Corps dam foreman and the ROC.
- b. See that all equipment at the reservoir such as recorders, indicating gages, gate mechanisms, power units, radios, etc., is in operating condition.
- c. Operate the gates in accordance with instructions from the ROC.
- d. Keep the ROC notified of any unusual developments such as trash accumulation, power failure, mechanical difficulties, gate vibration, etc.
- e. Follow the current fixed-gate operation schedule posted in the control house (Plate 10 of this document) in the event of loss of communication with the ROC.
- f. Assist engineers dispatched by the ROC during flood emergencies in every way possible.
- g. Maintain routine records such as water surface elevations, outflow gage heights, precipitation amounts, gate openings, and a daily log on prescribed forms.

**h.** Notify local authorities and interested agencies of anticipated releases from the reservoir when instructed to do so by the ROC or in the event of loss of communications with the ROC.

**i.** Obtain hydrologic and hydraulic data from other agencies upon request of the ROC.

Santa Ana River  
Drainage Basin



- Legend
- |  |                      |
|--|----------------------|
| <span style="color: red;">■</span> Water Surface/Precip      | Flood Control Basins |
| <span style="color: green;">▲</span> Stream                  | Reservoirs and Lakes |
| <span style="color: orange;">◆</span> Stream/Precip          | Mountain Peak        |
| <span style="color: blue;">●</span> Precip - with telemetry  | Lookout Mtn 5990     |
| <span style="color: blue;">●</span> Precip - no telemetry    |                      |
| <span style="color: pink;">●</span> Precip - ALERT telemetry |                      |

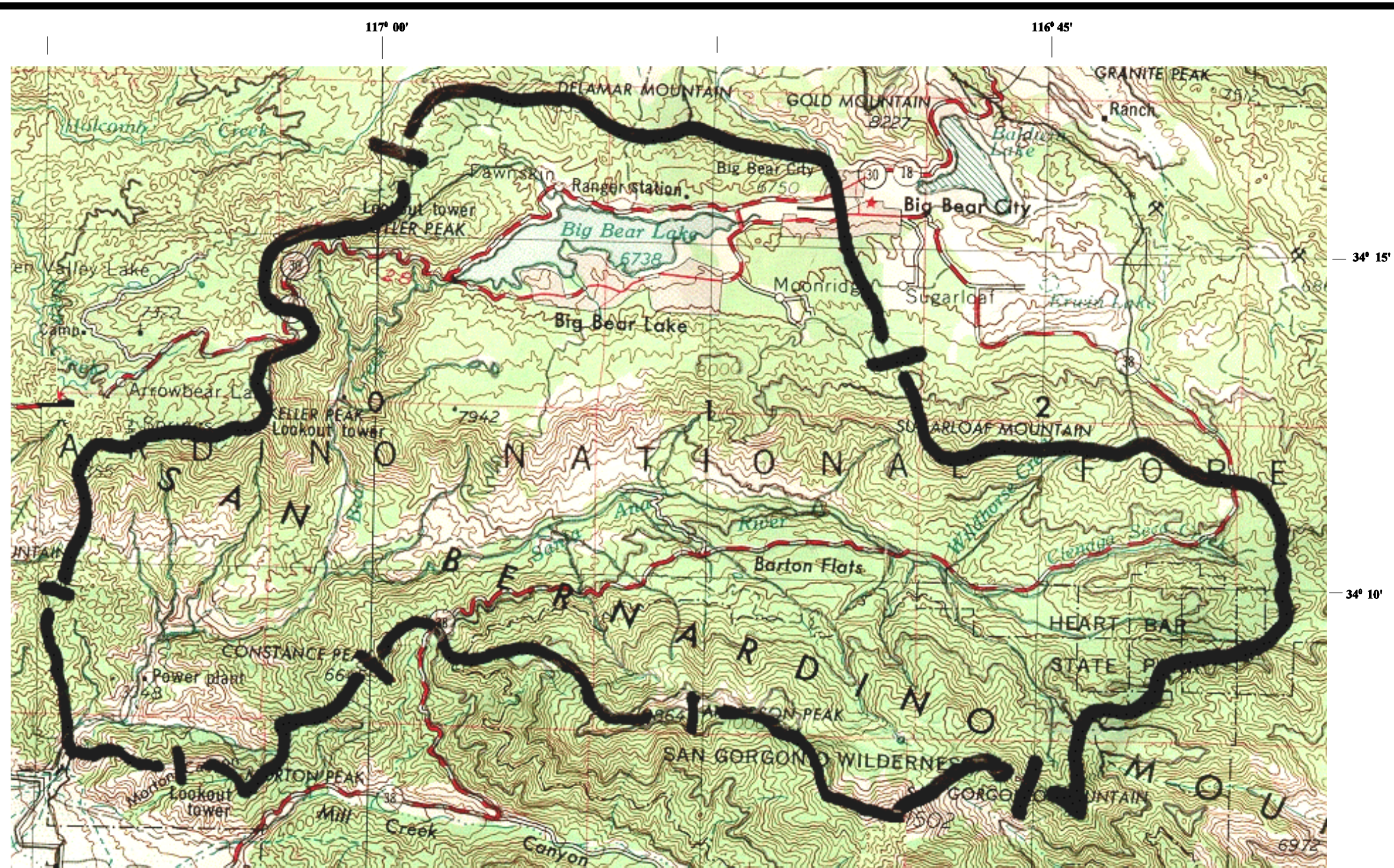
**SEVEN OAKS DAM  
SANTA ANA RIVER BASIN, CALIFORNIA  
INTERIM WATER CONTROL MANUAL**

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**SANTA ANA RIVER  
DRAINAGE AREA**

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**U.S. ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT**



**BOUNDARY OF DRAINAGE AREA**

**RESERVOIR POOL**

SEVEN OAKS DAM  
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**SEVEN OAKS DAM  
DRAINAGE AREA**

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Table 1. MINIMUM AND MAXIMUM GATE OPENING REQUIREMENTS		
GATE TYPE	MINIMUM GATE OPENING (FEET)	MAXIMUM GATE OPENING (FEET)
REGULATION OUTLET (R.O.)	.75	6.8
LOW FLOW (L.F.)	.5	2.8

Table 2. RECOMMENDED MAXIMUM RATE OF RELEASE CHANGE		
DISCHARGE	TO INCREASE FLOW	TO DECREASE FLOW
0 - 200	NO RESTRICTION	NO RESTRICTION
UP TO 500	250 CFS/HOUR	250 CFS/HOUR
500 - 4,000	500 CFS/HOUR	500 CFS/HOUR
4,000 -8,000	1000 CFS/HOUR	1000 CFS/HOUR

- NOTES:**
- SEDIMENT POOL:**
    - Additional stop logs are installed as necessary prior to each flood season. Sediment pool elevation may vary in any given year. Additional stop logs may be installed during the flood season, if necessary.
  - DEBRIS POOL:**
    - Prior to using LF and or RO gates, sluice gate needs to be opened. See Section 4.2.a of this document for procedures.
    - During falling stages, drain pool using MDL and LF gates down to elevation 2134 feet, NGVD. Below 2134 feet, NGVD, close the LF gate and the sluice gate and discharge using the MDL only.
  - INTERMEDIATE POOL:**
    - Maximum combined capacity of LF and MDL in this elevation range is 500 cfs.
  - MAIN TRASH RACK POOL:**
    - During RisingStages: Release 50 cfs.
    - During Falling Stages: Release theoretical maximum safe rates. The theoretical maximum Qs at different elevation ranges are:
      - @ 2265 ft, NGVD — Q= 500 cfs
      - @ 2269 ft, NGVD — Q= 1,000 cfs
      - @ 2273 ft, NGVD — Q= 1,500 cfs
      - @ 2299 ft, NGVD — Q= 2,000 cfs
    - Note that the rates shown can be adjusted depending upon the amount of trash observed, the proximity of the next storm, the time required to clean the racks, and other factors that directly or indirectly affect the operation of the dam.
    - See Table 1 for max. allowable gate openings
  - MAIN POOL:**
    - During Both Stages: Release theoretical maximum safe rates. The theoretical maximum Qs at different elevation ranges are:
      - @ 2299 ft, NGVD — Q= 2,000 cfs
      - @ 2300 ft, NGVD — Q= 5,000 cfs
      - @ 2400 ft, NGVD — Q= 6,500 cfs
      - @ 2500 ft, NGVD — Q= 7,000 cfs
      - @ 2580 ft, NGVD — Q= 8,000 cfs
    - See Table 1 for max. allowable gate openings
  - SPILLWAY SURCHARGE:**
    - During Rising Stages below el.2585 feet, NGVD, maintain a combined release total of 8,000 cfs. Above el. 2585 ft, NGVD, all gates shall be closed.
    - During Falling Stages: Gates may be adjusted to maintain the resulting maximum spillway flow for quicker evacuation of the remaining surcharge pool.
  - OPERATIONAL CONSIDERATIONS:**
    - For all release adjustments, see Tables 1 and 2.
    - Scheduled releases will be curtailed, if necessary, in order to assure the safe operation of the dam (i.e., exceedance of downstream channel capacity, or any other emergencies.
    - All release ranges shown can be cut or increased, as necessary, in order to allow safety inspection or for maintenance purposes.
    - Instrumentation Testing Program: Collection of data to verify the dam's performance may be done by if the opportunity exists; However, during the time this plan is in force, the Seven Oaks Dam releases will not be modified for such purpose.

DESIRED GATES TO USE	REQUIRED SLUICE GATE POSITION
RISING: None FALLING: See Note 6. MDL, LF, RO	RISING: OPEN * FALLING: OPEN *
RISING: MDL, LF, RO FALLING: MDL, LF, RO	RISING: OPEN * FALLING: OPEN *
RISING: MDL FALLING: MDL, LF, RO	RISING: OPEN FALLING: OPEN *
RISING: MDL & LF FALLING: MDL & LF	RISING: OPEN FALLING: OPEN (During rising stages see Section 4.2a of the Interim Water Control Plan prior to opening sluice gate)
RISING: MDL FALLING: MDL & LF	RISING: CLOSED** FALLING: OPEN (>2134 ft, NGVD) CLOSED (< 2134 ft, NGVD)
RISING: MDL FALLING: MDL	RISING: CLOSED** FALLING: CLOSED

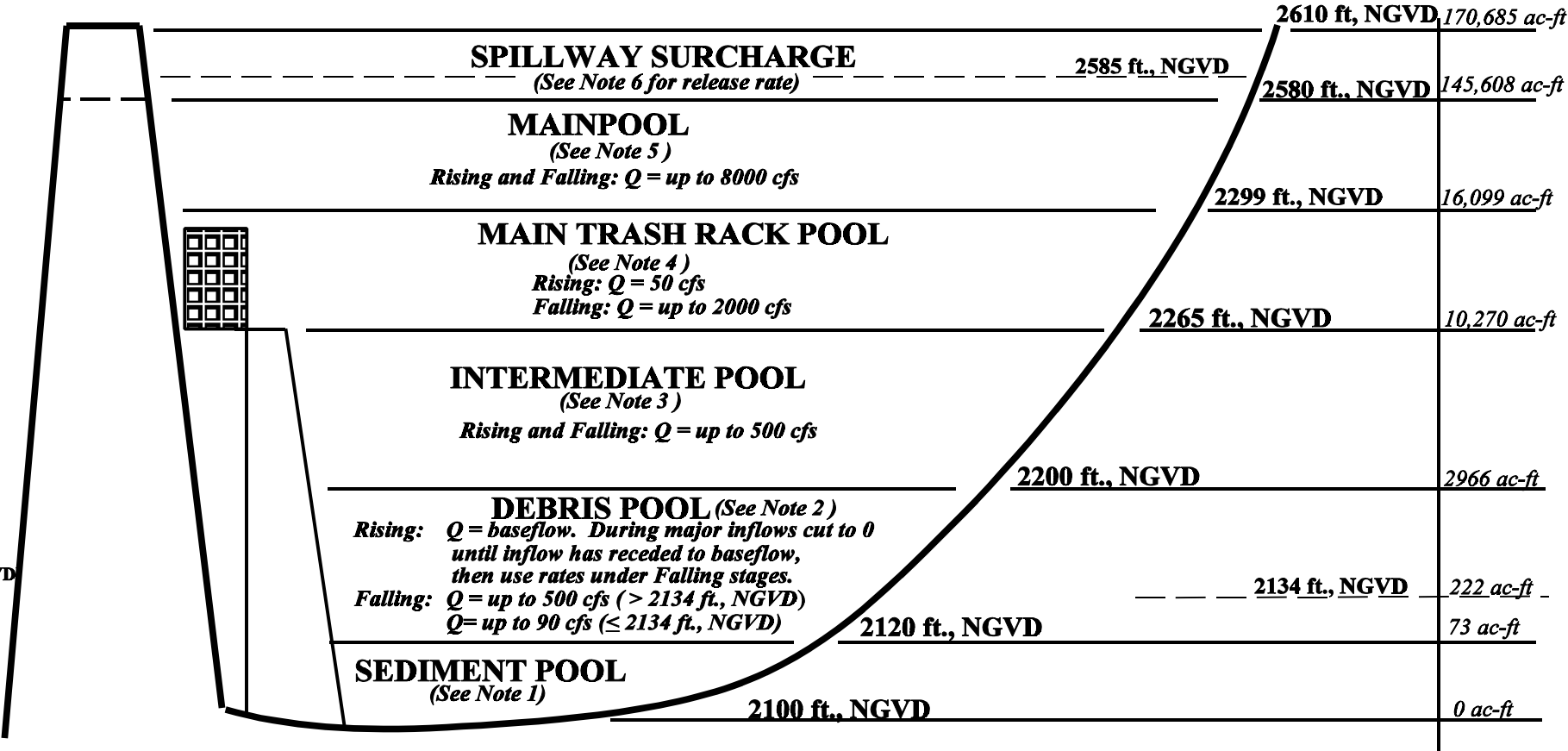
\* May be closed if necessary. Prior to closure during high flows, however, the LF and RO gates must be temporarily closed to avoid the possibility of damaging the sluice gate.

\*\* : Once available, a piezometer reading in each wet well will be used to determine when the required head differential is achieved to operate the sluice gate, as described. However, the digital display used to obtain these readings has not been installed to date. In the meantime, in order to prevent the risk of damaging the sluice gate, it will be opened as soon as ROC determines that a significant amount of inflow is projected. Once the digital display is installed and calibrated, the operation of the sluice gate will be done based on the required head differential, as described in the manual).

(For detailed drawings of the outlet works features, see Plates 3, 4, 5, 6, 7, and 8 of this document)

MDL - Minimum Discharge Line  
LF - Low Flow Gate  
RO - Regulation Outlet Gates

Storage values shown derived from January 1986 survey data. New storage table will be developed as soon as new survey data is available.



## Interim Plan Diagram Water Year 2000

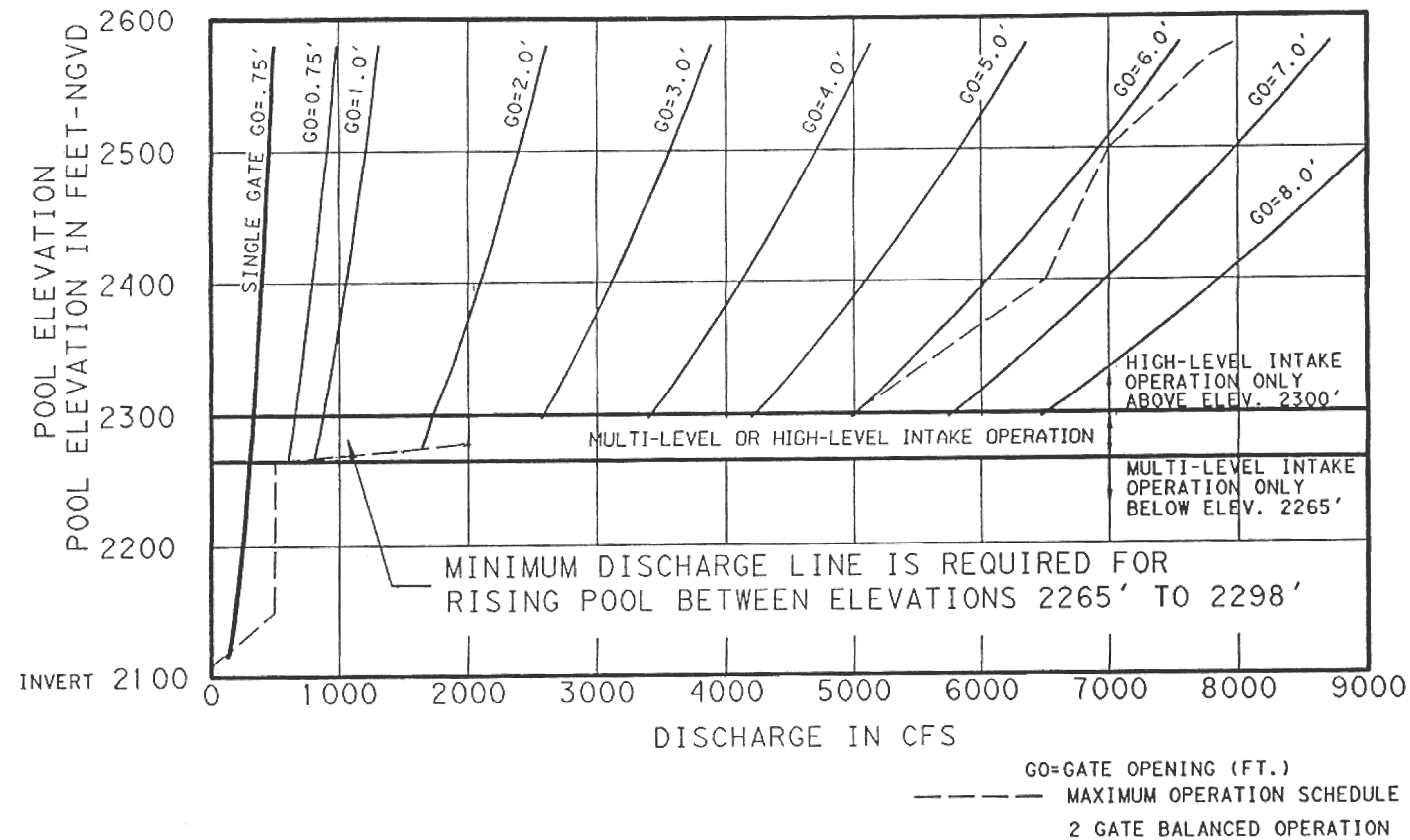
SEVEN OAKS DAM  
SANTA ANA RIVER BASIN, CALIFORNIA  
WATER CONTROL PLAN

Interim Water Control Plan Diagram  
Prior to and During Section 7  
Consultation Period

U.S. ARMY CORPS OF ENGINEERS  
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# SEVEN OAKS

## GATE RATING

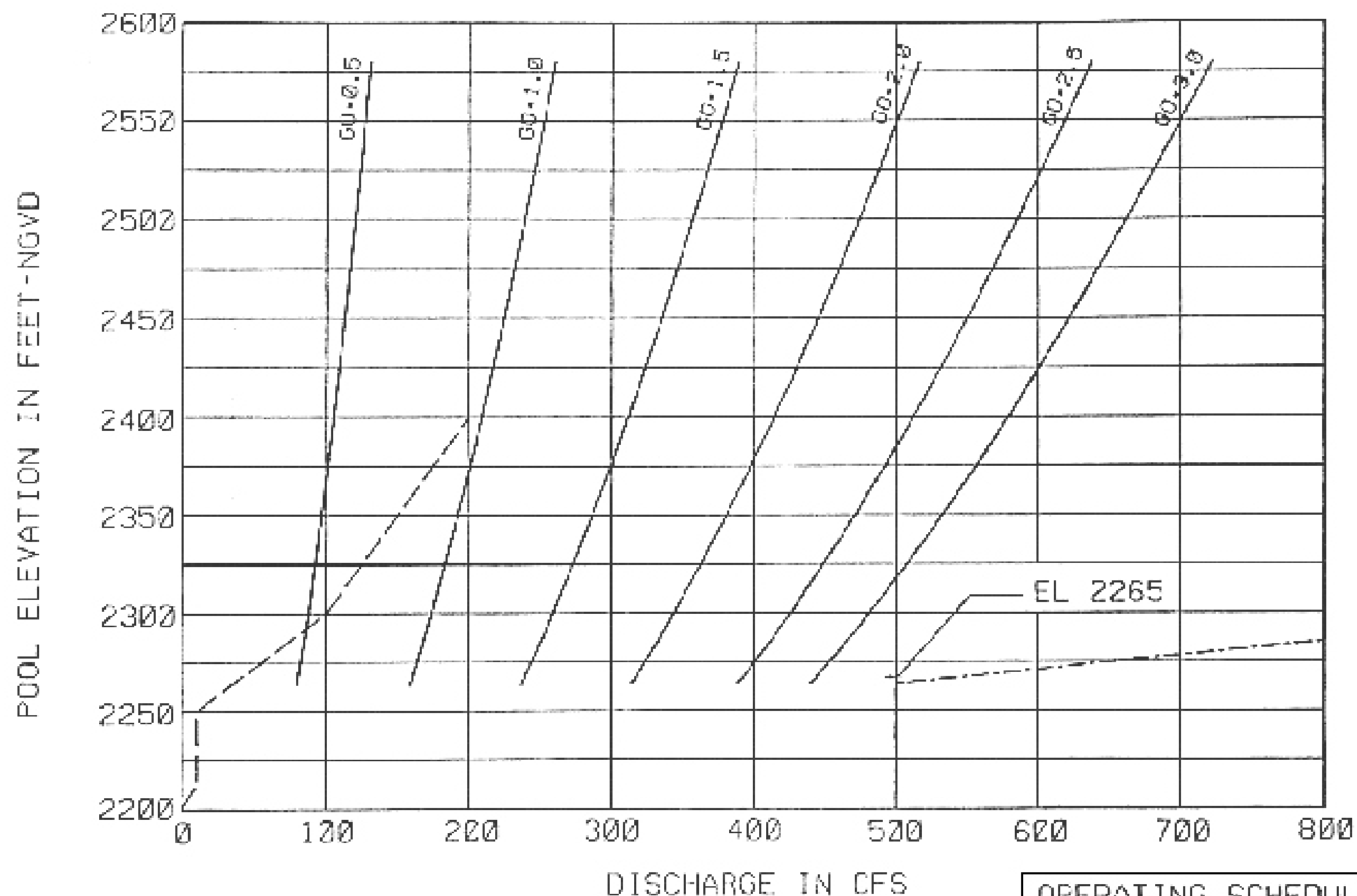


SEVEN OAKS DAM  
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INTERIM WATER CONTROL MANUAL

HIGH LEVEL INTAKE  
RO GATE RATING

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# SEVEN OAKS GATE RATING



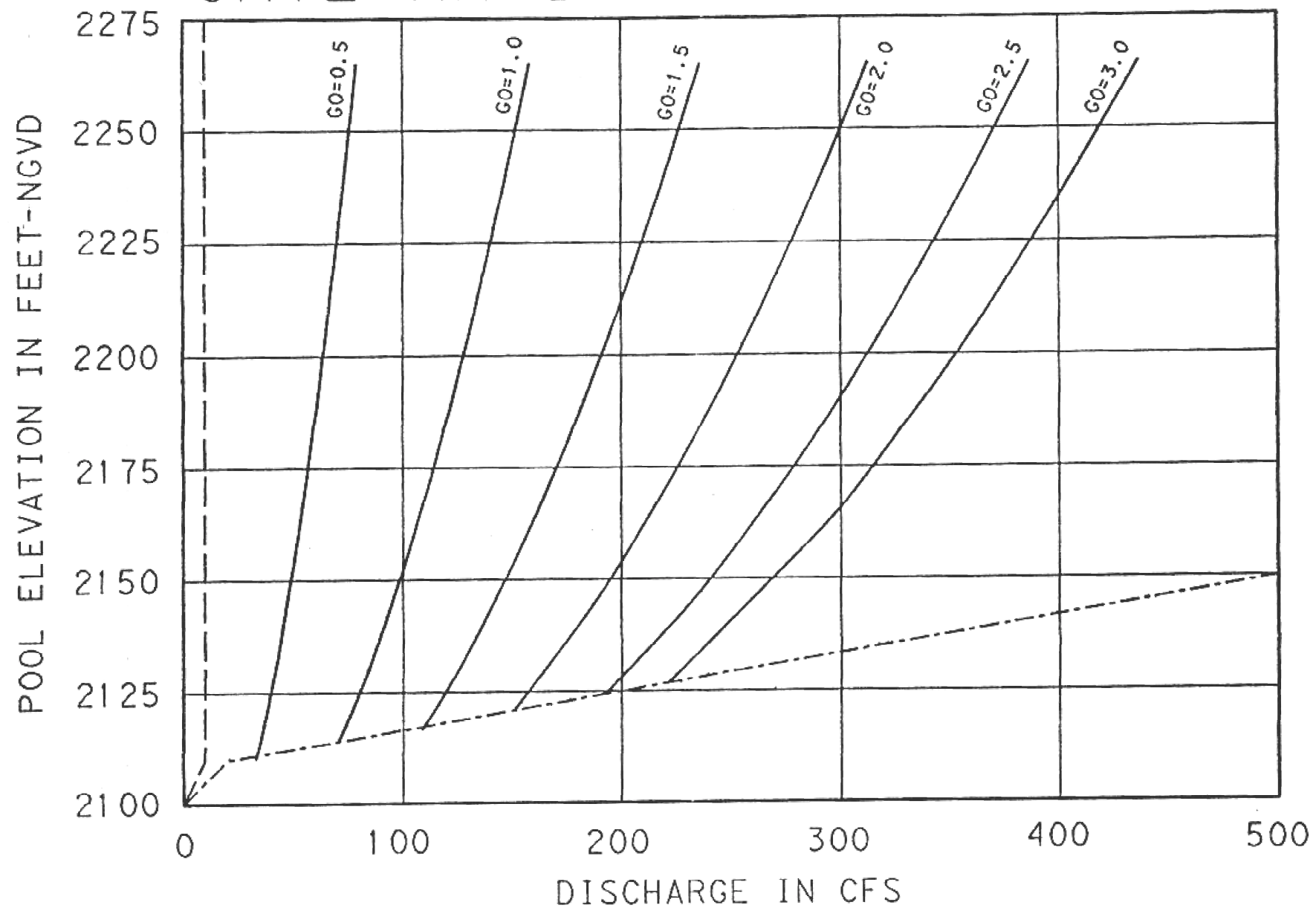
OPERATING SCHEDULE  
 - - - - - MAXIMUM RELEASE  
 - - - - - MINIMUM RELEASE

SEVEN OAKS DAM  
 SARATOGA RIVER BASIN, CALIFORNIA  
 INTERIM WATER CONTROL MANUAL

HIGH LEVEL INTAKE  
 LOW FLOW GATE  
 RATING

U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT

# SEVEN OAKS GATE RATING



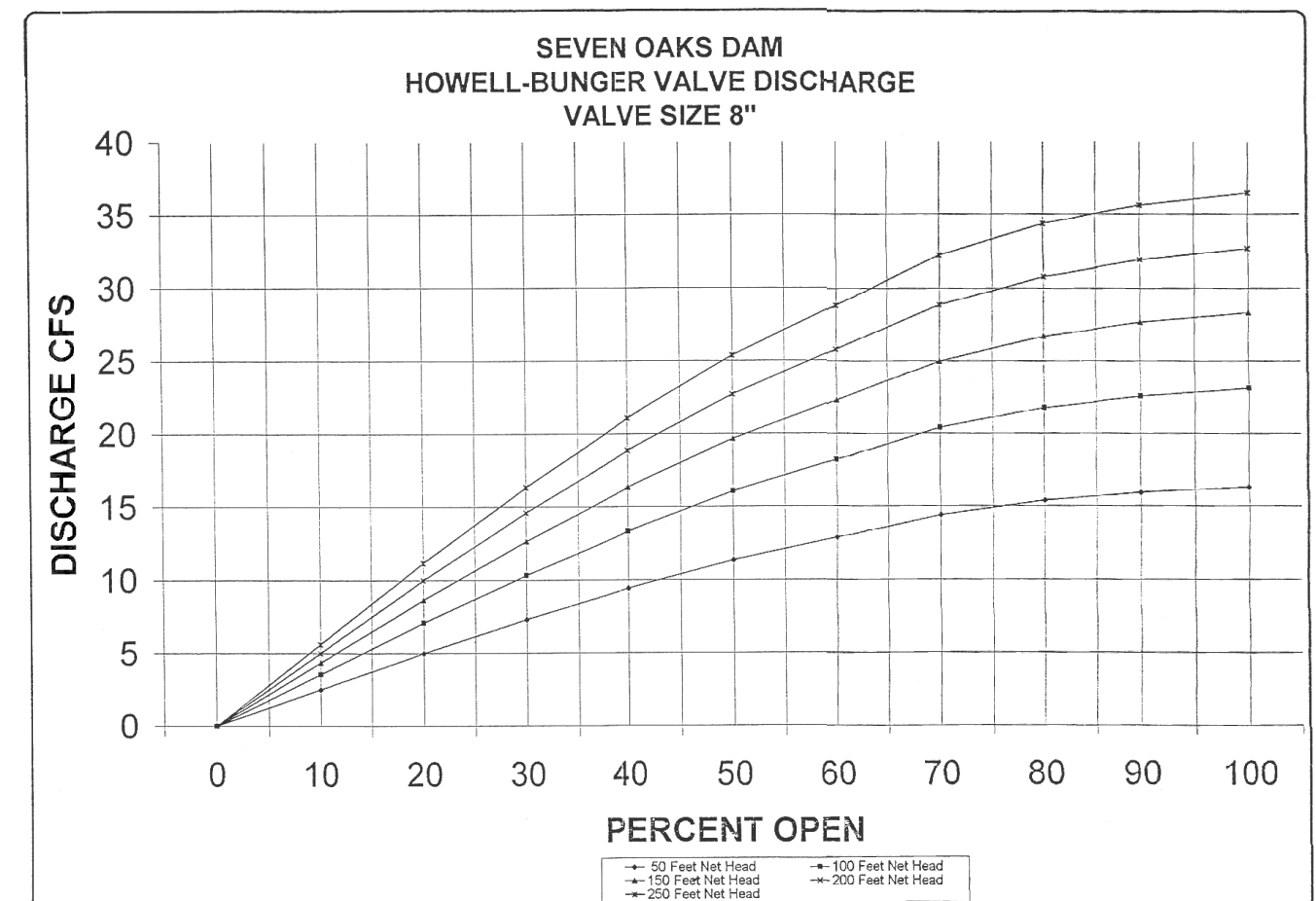
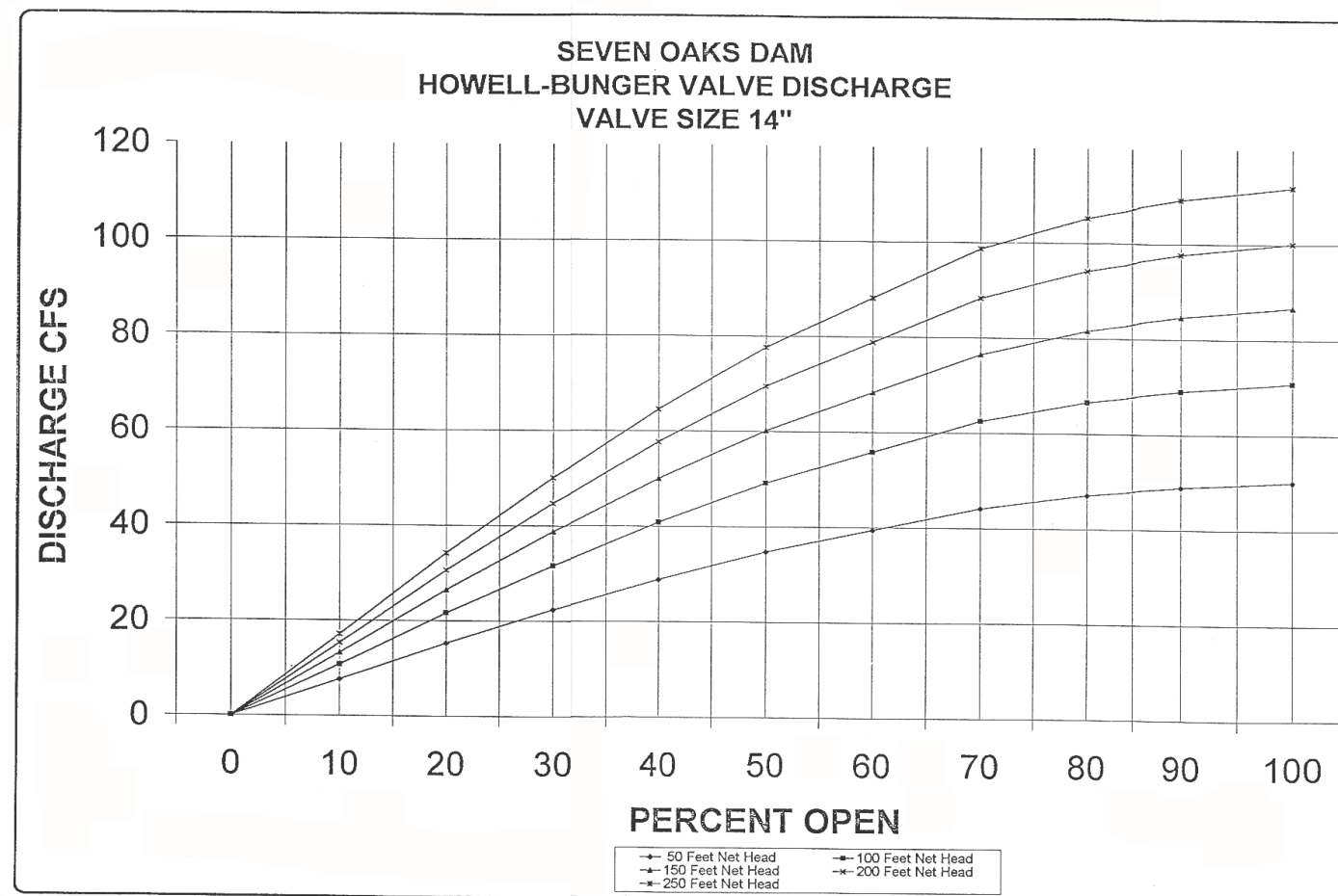
## OPERATION SCHEDULE

----- MAXIMUM RELEASE  
 -.-.-.- MINIMUM RELEASE

SEVEN OAKS DAM  
 SANTA ANA RIVER BASIN, CALIFORNIA  
 INTERIM WATER CONTROL MANUAL

MULTI-LEVEL  
 WITHDRAWAL SYSTEM  
 LOW FLOW GATE RATING

U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT



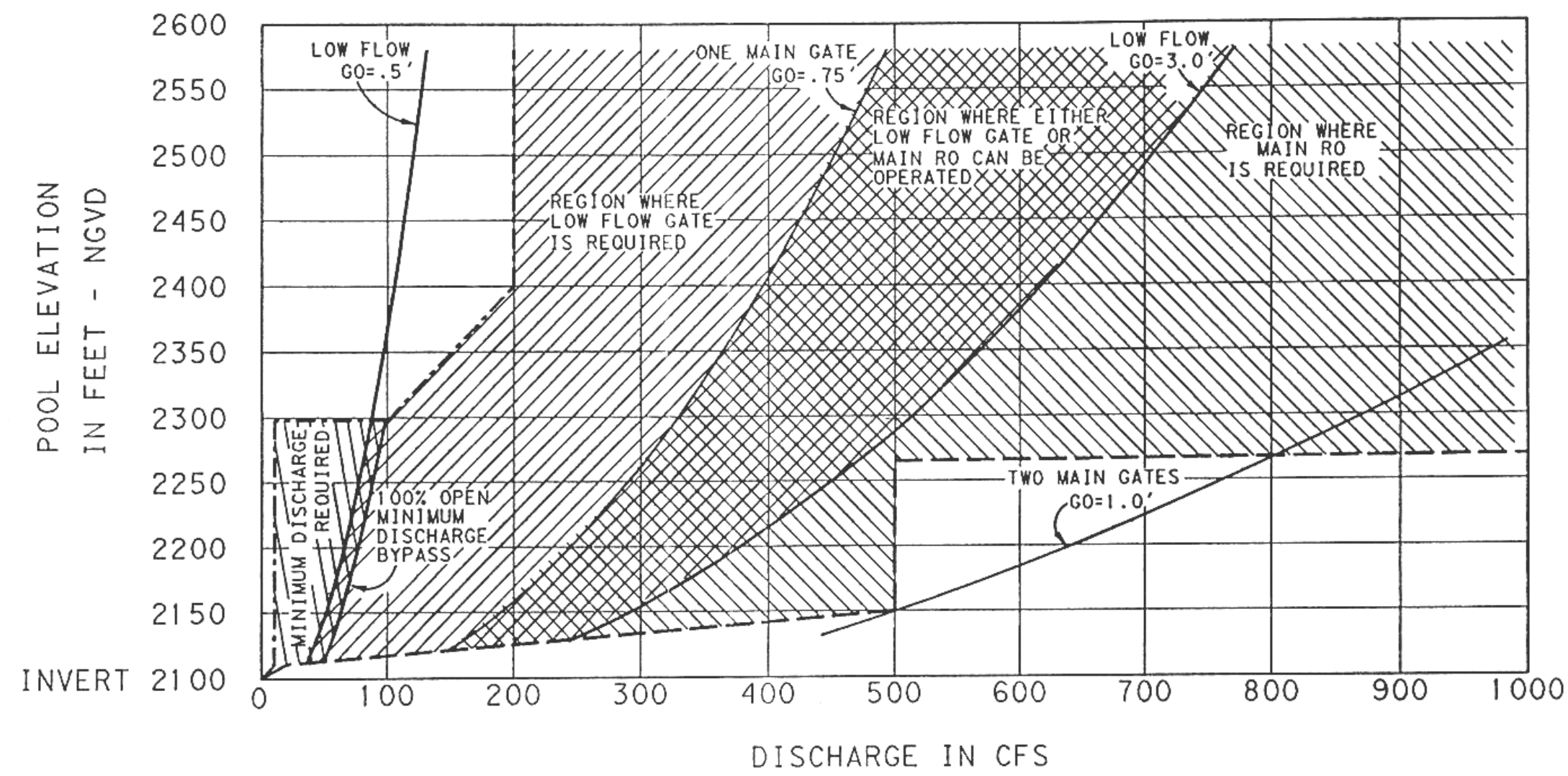
SEVEN OAKS DAM  
SANTA ANA RIVER BASIN, CALIFORNIA  
INTERIM WATER CONTROL PLAN

**MINIMUM DISCHARGE LINE  
RATING CURVES  
14 - INCH AND 8 - INCH CONE  
VALVES**

U.S. ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

# SEVEN OAKS

## GATE RATING



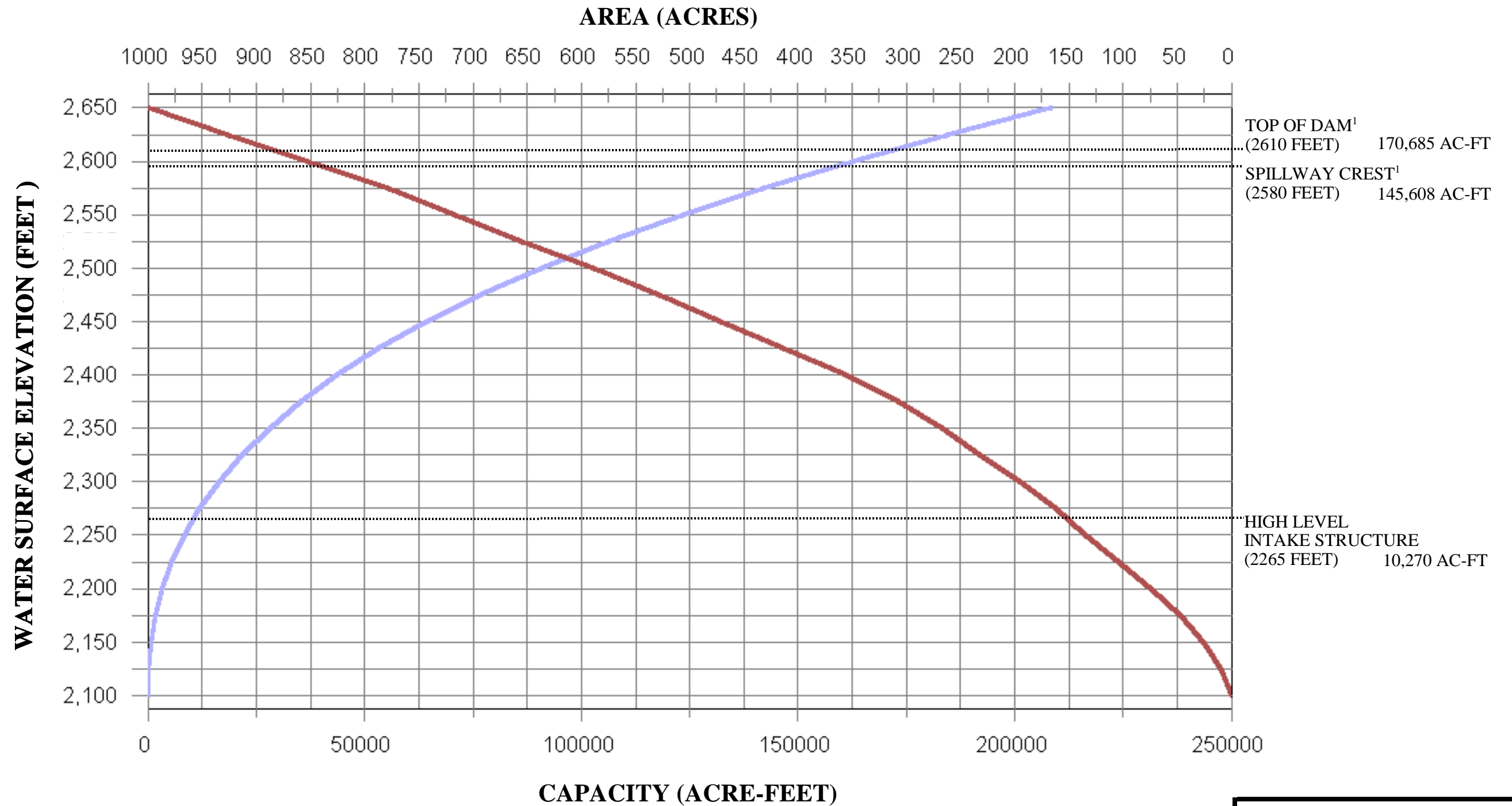
HIGH-LEVEL INTAKE OPERATION ONLY ABOVE ELEV. 2300'  
 MULTI-LEVEL OR HIGH-LEVEL INTAKE OPERATION BETWEEN ELEV. 2300' AND 2265'  
 MULTI-LEVEL INTAKE OPERATION ONLY BELOW ELEV. 2265'

GO=GATE OPENING (FT.)  
 ----- MINIMUM OPERATION SCHEDULE  
 - - - - - MAXIMUM OPERATION SCHEDULE

SEVEN OAKS DAM  
 SANTA ANA RIVER BASIN, CALIFORNIA  
 INTERIM WATER CONTROL MANUAL

GATE OPERATING  
 REQUIREMENTS

U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT



AREA AND CAPACITY FIGURES BASED ON 1989 SURVEY

SEVEN OAKS DAM  
SANTA ANA RIVER BASIN, CALIFORNIA  
INTERIM WATER CONTROL PLAN

SEVEN OAKS DAM RESERVOIR  
AREA - CAPACITY CURVE  
SURVEY 1989

U.S. ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT